Institute for Materials Science

UNCLASSIFIED

IMS Distinguished Lecture Series

Professor Andrew J. Millis
Department of Physics
Columbia University

Meeting Dirac's Challenge: Interacting Electrons in and out of equilibrium

Tuesday, September 27, 2016
2:00 - 3:00 pm
MSL Auditorium (TA-03 - Bldg 1698 - Room A103)

Abstract: This talk will present an overview of recent progress towards a solution of one of the grand-challenges of modern science: understanding the properties of interacting electrons in molecules and solids. After an introduction to the physics I will argue our theoretical understanding of a basic model system, the two dimensional Hubbard model, has reached the level that we can say with confidence that its superconducting properties capture key aspect of the high-Tc superconductivity in copper-oxide materials. I will then summarize the current status of our extension of the methods to fully physically realistic systems, emphasizing the areas of theoretical uncertainty and the prospects for resolution. Finally I will discuss the new frontier of the nonequilibrium physics of strongly driven electronic systems, presenting a model for high transition temperature superconductivity driven by nonlinear phononics.

Work in this area is supported by the NSF under grant DMR-1308236 and the Department of Energy under grants ER-046169 and SC--0012592

Bio: Professor Millis received the A. B. Degree, magna cum laude with highest honors in physics, from Harvard University in 1982 and the Ph.D. degree from MIT in 1986. His thesis research at MIT, conducted under the supervision of Professor Patrick Lee, established one of the basic theoretical approaches to the physics of 'heavy electron' compounds. From 1986 to 1996 he was first a postdoctoral and then a permanent member of technical staff at A. T. & T. (later Lucent technologies) Bell Laboratories, where he did foundational work on quantum critical phenomena in metals, provided the basic model used to interpret nuclear magnetic resonance measurements in high temperature superconductors, and uncovered the fundamental importance of electron-lattice coupling to the physics of 'colossal' magnetoresistance manganite materials.

After leaving Bell Labs Professor Millis served on the faculties of The Johns Hopkins University and of Rutgers University, before joining Columbia University in 2001, where he is Professor of Physics. His recent work includes establishing the theory of electrons in oxide superlattices, the development and use of continuous time quantum Monte Carlo methods for computing the properties of correlated electron materials, major contributions to the methodology of dynamical mean field theory, and the demonstration that the two dimensional Hubbard model contains much of the anomalous physics associated with high Tc superconductors.

Millis was Chair of the Columbia Physics Department from 2006-2009 and is presently Associate Director for Physics at the Simons Foundation where he helped put in place major programs for philanthropic support of math, physics and computer science and helps manage a $40M portfolio of research support. He is a Fellow of the American Physical Society and of the American Association for the Advancement of Science (where he is a member at large in the Physics Section), and is a Foreign Associate of the Canadian Institute for Advanced Research. He was appointed as Professeur Visiteur at the College de France in 2015 and will be the Sommerfeld Lecturer at the LMU in Munich in 2017. He has served as a Trustee of the Aspen Center for Physics and has on numerous advisory boards, including that of the Kavli Institute for Theoretical Physics, which he Chaired.

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Hosted Alexander Balatsky * Director of the Institute for Materials Science

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